



Critical weed-free period for soybean

CATEGORY [weeds](#) | June 17, 2020

Soybeans grown in narrow rows shortened the critical weed-free period (CWFP) by up to three soybean developmental stages at site-years with increased weed pressure. Low-density soybean stands lengthened the CWFP by one soybean developmental stage compared with higher-density soybean stands. Generally, the cultivar with the shortest days to maturity, which also had the shortest stature, consistently had a longer CWFP.

Soybean seedlings are poor competitors against weeds. Yield potential is maximized when weeds are controlled until at least the V3 stage. This is referred to as the critical weed-free period (CWFP), which is the duration of time the crop must be kept weed-free to minimize yield loss. Shortening the CWFP means that the crop can outcompete the weeds at an earlier growth stage, resulting in less need for later weed control.

Three experiments evaluated the effects of row spacing, plant stand densities, and cultivar on the CWFP in soybean. The researchers hypothesized that the CWFP for soybean could be shortened through narrowed row spacing, increased plant stand densities, and using longer-season cultivars that have a tall stature.

The research was conducted at Carman, St-Adolphe and in the rural municipality of Whitemouth, Manitoba in 2016 and 2017. Fields were managed using fall and/or spring conventional tillage practices before establishment of the experiments.

Narrow row spacing reduced CWFP

Narrow (7.5 inch; 19 cm) and wide (30 inch; 76 cm) row spacing were compared in one experiment. DKB2360 was seeded at a density 180,000 plants per acre (444,600 plants/ha).

In the narrow-row soybean treatments, canopy closure occurred between the third (V3) and fourth (V4) trifoliolate leaf stages.

Seeding soybean in narrow rows reduced the duration of the CWFP compared with soybean seeded in wide rows. This was observed at 3 of 6 site-years at Carman 2016 and 2017, and Whitemouth 2016. At these 3 site-years, peak-season weed biomass was greatest, indicating the importance early season weed control.

A similar trend was also observed at both St-Adolphe site-years, although these differences were not statistically significant. When all site-years were combined, the CWFP in soybean grown in narrow rows was shortened by 104 GDD, which equated to about 1.5 soybean developmental stages. At Carman 2017 under heavy weed pressure, the CWFP was shortened with narrow rows by three soybean development stages.

Higher plant density improved weed competition

In the soybean density experiment, the DKB23-60 soybean cultivar was seeded at target densities of 135,000, 180,000, and 270,000 plants per acre (333,500, 444,600, and 666,900 plants/ha). These seeding rates were 0.75X, 1.0X, and 1.5X of locally recommended standard target densities. Row spacing was at 14.75 inches (37.5 cm).

The combined analysis revealed that the low (0.75X) soybean plant densities lengthened the CWFP compared with standard (1.0X) or high (1.5X) soybean plant densities. No differences in the CWFP were observed between the 1.0X and 1.5X plant densities in the combined analysis or in the individual experiments.

Overall, the CWFP in low-density soybean stands was extended by 85 GDD compared to the standard seeding rate and 118 GDD compared to increased stand densities, which corresponded to roughly two soybean developmental stages. At the individual site-years, low soybean plant densities extended the CWFP from between one and two soybean developmental stages.

Shorter CWFP with later maturity, taller cultivars

The variety experiment compared three glyphosate-resistant soybean cultivars with different maturity ratings and plant architecture/stature. The cultivar DKB22-60 is a short-statured plant that matures at about 2275 CHU (corn heat unit); DKB23-60 is a tall-statured plant that matures at 2350 CHU; and DKB24-10 is a medium- to tall-statured plant that matures at about 2425 CHU. Row spacing was at 14.75 inches (37.5 cm).

Weed removal treatments with a glyphosate + bentazon tank-mix were compared at 5 different growth stages at the expanded unifoliate leaf (VC), V1, V2 or V3 vegetative stages, or the beginning of flowering (R1). After weed removal at a specific stage, natural weed populations were allowed to emerge, grow and compete with the crop for the remainder of the season. One season-long weedy and three season-long weed-free controls were also compared.

The effect of soybean cultivar varied among locations, yet tended to be consistent within location over the 2-year study.

At Carman, the duration of the CWFP was lengthened in the earliest maturing soybean cultivar, DKB22-60. This equated to about one soybean developmental stage. No differences in the CWFP were observed between DKB23-60 and DKB24-10.

At Whitemouth, soybean cultivar had no effect on the CWFP in either year.

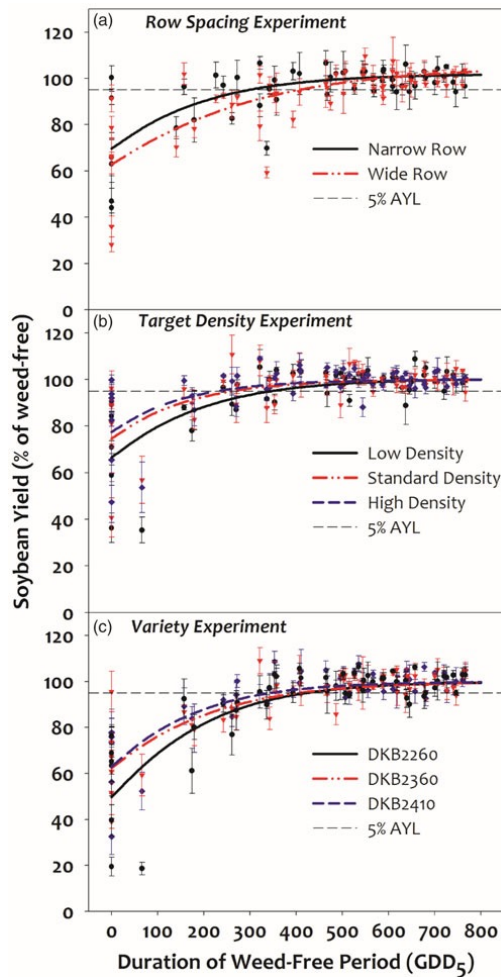
Inconsistent results were observed at the St-Adolphe location. In 2016, the CWFP in DKB23-60 was up to 67 GDD longer than the other two cultivars. The opposite was observed in 2017, when the CWFP in DKB23-60 was 176 GDD shorter than DKB22-60, and 272 GDD shorter than DKB24-10.

Yield results

In 2016, narrow-row soybean produced between 19% and 29% more seed yield than wide-row soybean. No differences in soybean yield were observed between the row-spacing treatments in 2017.

In the target density experiment, soybean yield in the low-density treatment was 5% lower than the standard and 8% lower than the high-density treatments. No yield differences were observed between the standard and high-density treatments.

Graphical representation of the critical weed-free period of soybean for three cultural weed management experiments in Manitoba.



Source: Gulden and Rosset. 2019

Overall, the research found that combining narrow-row spacing and standard or increased plant densities with a regionally appropriate cultivar choice may shorten the CWFPP in soybean grown on the Prairies. This may potentially reduce the need for herbicides and the selection pressure for HR weed biotypes.

The Manitoba Pulse and Soybean Growers supported the project with support from Richardson's Kelburn Farm, and Monsanto Canada Inc. for providing the seed.

Rosset JD and Gulden RH (2020) Cultural weed management practices shorten the critical weed-free period for soybean grown in the Northern Great Plains. *Weed Sci.* 68: 79–91.

<https://doi.org/10.1017/wsc.2019.60>